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The Effect of Auditory Cues on the Bowling Performance of the Visually Handicapped

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THE EFFECT OF AUDITORY CUES ON THE BOWLING PERFORMANCE OF THE VISUALLY HANDICAPPED

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Date August 6, 1975 Martin Ruthoff
Coordinator of Graduate Study

This thesis is dedicated

to my parents

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The present investigation was conducted to study the effect of an auditory cue on the bowling performance of visually handicapped students. The sample consisted of thirty visually handicapped subjects (fifteen congenital and fifteen acquired). Subjects were randomly assigned to a sequence of bowling tasks. The task involved bowling with and without an audible goal locater. It was hypothesized that the utilization of the audible goal locater would significantly improve the bowling performance of visually handicapped students. This study further investigated the relationship between onset of visual impairment and bowling performance. Based on statistical analysis the hypothesis was supported. It was found that bowling performance was significantly superior with the utilization of the audible goal locater than without for both acquired and congenitally visually handicapped students. Further, bowling performance of the acquired visually handicapped was significantly superior to the bowling performance of the congenitally visually handicapped with and without the audible goal locater. It was concluded that the utilization of the audible goal locater can increase bowling performance of the visually handicapped.

CHAPTER I

INTRODUCTION

Physical educators and recreators have heralded bowling for the visually handicapped in terms of its physical, social, and emotional values (Buell, 1966; Miller, 1971, 1975; Pitzer, 1974). Helen Keller has stated that the "curse of the blind is not blindness, but idleness" (Taylor, 1951, p. 5). This idleness is usually brought about by fear and overprotection of parents, and may result in poor motor performance (Buell, 1966). Involvement in physical activity may allay this idleness. Additionally, the literature appears to confirm the supposition that the visually handicapped lack to a great extent physical vitality, strength, agility, and kinesthetic awareness. Adams, Daniel, and Rullman (1972) stated that children who are blind or have extremely poor vision lack skills in body control, static balance, coordination, and agility. Many of these children need to develop better physical fitness, improve their coordination, and acquire skills in large muscle activity. Bowling offers a moderate amount of activity which may contribute to fitness, but more importantly, the development of proficient skill in bowling contributes to social interaction. Physical education is one of the first subjects where mainstreaming initially occurs. Recreation has been the forerunner of normalization for the last two decades. Visually handicapped

individuals must possess a minimal level of gross motor skills to function close to the normal patterns of school and society.

Deficient physical fitness can be overcome as skill develops in fundamental movements. With improved fitness and manipulative skills, the visually handicapped can then participate with reasonable success in the game activities (The University of the State of New York, 1970). Buell (1973) asserted that although the physical fitness of the visually handicapped is low, it need not by that way. As a child develops fundamental movements to explore the environment, perhaps an increment in fitness might occur.

In light of these problems of the lack of physical vitality, strength, agility, and kinesthetic awareness, many educators have attempted to improve the levels of physical achievement of the visually handicapped through the use of sensory aids. There are many forms of sensory aids which transmit information through the various sensory modalities. Perhaps the single most important aid contributing to the independence of the visually handicapped was the invention of Braille. This system of raised dots has had a spin off effect into a number of aspects of educational, social, recreational, and home life. Several varieties of Braille writers, slates, and tape label makers have recently been developed. In addition to Braille, other equipment, tools, watches, clocks relief maps, and the long cane method of orientation and mobility have all added to the independence of the visually handicapped. Recreational activities also utilize Braille in the forms of card

and board games. Other aids which are more directly related to the use of specialized equipment for the visually handicapped in sport are audible balls, an audible goal locater, tandem bicycles, bicycle merry-go-rounds, stationary exercycles, multi-textured archery targets, aluminum guide rails for bowling, touch pin locaters of the remaining pins in bowling, guide wires for track, and electronic homing/error detection devices for track (Balmer, 1970).

Due to the nature of a visually impaired individual, the visual mode of information gathering has either been eliminated, or severely reduced. Therefore, the aids which would be the most effective are those which rely on the kinesthetic (inclusive of the proprioceptive and tactile) senses, and/or the auditory sense. Furthermore, where distance is too great for contact, an impasse is presented in the utilization of the tactile sense, rendering only the auditory and kinesthetic senses functional for perceptual processes.

According to Buell (1950, p. 72) the factors affecting motor performance of the visually handicapped are: "(1) amount of vision, (2) duration of the visual handicap, or age of onset, (3) parental attitude, and (4) the physical education received." Physical education can play an important role in factors three and four as cited by Buell. It is the responsibility of the physical educator to aid in parental understanding of the movement capacities of the visually handicapped, and to assist the visually handicapped child to meet his needs, particularly social and emotional and to

overcome the "curse of idleness" placed upon him by the sighted.

One means through which the visually handicapped may overcome this "curse" is through a leisure time activity such as bowling, utilizing a kinesthetic guidance device. Miller, the President of the American Blind Bowling Association reported that:

> The rapidly increasing popularity of bowling reflects the physical and recreational value of the activity for the blind. As an exercise, bowling is stimulating, but not strenuous, and in many cases is the only non essential exercise that is engaged in by the blind. It can be enjoyed by all age groups and both sexes. As a recreational activity, it is one of the best, and one of the few that the blind can participate on an almost equal footing as sighted friends and relatives. The sense of achievement experienced by a blind bowler who has just rolled an impressive score is invaluable in building or restoring confidence. Bowling also shows the blind, especially the newly blind that they can excell in spite of their visual limitations. This restored knowledge frequently carries over into their occupational and social behavior (Miller, 1971, p. 60-61).

Although sensory aids are widely used by the visually handicapped, there is a paucity of research relative to their value in teaching motor skills. Furthermore, there is little research to demonstrate through which modality the visually handicapped most efficiently learn, be it auditory, tactile, or kinesthetic. Educators of the visually handicapped utilize all three modalities in varying degrees. In the non-physical situations, it has been demonstrated that the auditory modality (recorded material) may be up to 360% more efficient than information transmitted through the tactile modality (Morris, Nolan & Phelps, 1973).

In accordance with our knowledge of the efficiency of the auditory modality in the non-physical situation, there could be some degree of positive transfer of auditory efficiency in the physical education setting. More research is needed however, which deals with the performance of motor skills and the relative effectiveness of various kinds of sensory cues on performance improvement. The preponderance of the literature has dealt with fine motor skills, or was motorically passive in nature. Thus generalizations can only be tentative, and are only defensible until more research is forthcoming pertaining to the importance of vision or audition in the performance of athletic contests and physical education (Cratty, 1967; Schrader, 1968).

In summary, auditory aids are frequently used in physical education programs for the visually handicapped, however, there is a void in the research on the effectiveness of these aids to increase performance of specific motor skills. Bowling is one activity of physical education where auditory aids have not been substantially employed. Leading authorities in the area of physical education and recreation have attested to the physical, social, and emotional value of bowling for the visually handicapped (Buell, 1966; Miller, 1971, 1975; Pitzer, 1974). These values which are inherent in bowling for the visually handicapped merit the effort necessary to improve bowling performance.

Statement of the Problem

This study investigated the effect of the audible goal locater on the bowling performance of visually handicapped children.

Hypothesis

The use of the audible goal locater will significantly improve bowling performance of the visually handicapped.

Limitations

1. Sound localization and discrimination are not innate abilities of the visually handicapped, therefore students at the New York State School for the Blind receive auditory training as a regular part of their educational experiences. The length of time of the subjects' attendance at this school was not a factor of consideration, consequently the period of auditory training received by the subjects might have influenced the results of this study.
2. Sixty percent of all school age visually handicapped children attend public schools, yet all subjects for the present study were taken from a residential school. Therefore, results should not be generalized to other populations.

Delimitations

1. This study is delimited to thirty boys and girls between the ages of eleven years, one month, and twenty-one years four months, who are residents of the New York State School for the Blind.
2. Frequency, pitch, volume, and placement of the goal locater were held constant for all subjects, regardless of individual differences in auditory thresholds.

Definitions

For the purposes of this study, the following terms were used:

Visually Handicapped. Educators define visually handicapped as those individuals who must be educated through channels other than vision, or require the use of special aids to capitalize on any residual vision (Arnheim, Auxter & Crowe, 1969). Henceforth to be referred to as VH.

Congenital Blindness. A condition in which a lack of vision originates either prenatally or natally.

Acquired Blindness. A condition in which a lack of vision is manifested sometime after birth.

Legally Blind. Refers to those visually handicapped individuals who possess no better than 20/200 in the better eye with correction, or with a visual field limitation of twenty degrees or less (Hewett, 1974).

Audible Goal Locater. An electronic apparatus which emits a sound which can be regulated for pitch, volume, and frequency.

CHAPTER II

REVIEW OF THE LITERATURE

Virtually everything man does is in someway dependent on sensory experiences. Research has demonstrated that gross motor skill performance can often be enriched through the utilization of various sensory objects, marks, spots, or devices (Anderson, 1942; Dale, 1959; Dillon, 1952; Kaye, 1965; Lauer, 1971; Lindeburg & Hewitt, 1965; Mathews & McDaniel, 1962; Watkins, 1963). These aids transmit information through the visual, kinesthetic, haptic, and auditory channels, and may be used as temporary, or continual performance aids. Frequently used examples of these aids are bicycle training wheels, double bladed ice skates, batting tees, inclined mats for gymnastics stunts, hand paddles for swimming, deflatable bubbles for swimming, and the technique of spot bowling.

Numerous investigations of gross motor skill performance by the sighted utilizing varied aids have indicated that they effectively augment performance. If instructional devices are valuable sources if input for the sighted, these types of devices may also aid the visually handicapped (VH) in gross motor skill performance.

There is an abundance of information devoted to the poor motor skill of the VH, and the plausible causes of this condition (Adams, Daniel & Rullman, 1972; Buell, 1973; The University of

New York, 1970). In contrast, there is a scarcity of literature related to efficient teaching techniques. The literature, which is primarily clinical in nature, has dealt with tactile or haptic aids for the VH, or is related to academic learning. As a continuation of the previous research which has dealt with audition in the VH, (Axelrod, 1959; Calhoun, 1971; Conkey & Schneiderman, 1968; Cratty, 1969; Goldish, 1968; Hare, Hammil & Crandell, 1970; Simpkins, 1971; Wright & Dupress, 1968), this study investigated the effect of the audible goal locater on VH bowling performance.

The literature reviewed in this chapter is divided into four sections. The first section will review the literature pertaining to the function of the auditory modality. Section two will review the literature which deals with the auditory modality in the visually handicapped. Section three will be concerned with the relevant research on auditory training. Section four includes literature pertaining to the significance of audition in gross motor performance.

Auditory Modality

Gibson (1966) stated that the function of the auditory system is to permit arousal of the auditory sensations, to establish the direction of an event (localization), and to identify the nature of the event. The primary factor which allows one to localize a sound is two sense organs being separated in space. When a sound is emitted, the waves will travel to the

ears reaching them through different pathways, at different times. This results in an imbalance in stimulation. Man reacts to this imbalance by turning the head so that the two sound sources are symmetrical, thus having accomplished localization. Gibson further stated that this same process by which man localizes, also allows him to be a selective listener, or to discriminate a particular sound from a background of noise.

A study by Bruininks and Clark (1970) sought to discover the modality preferred in the learning process of first, third, and fifth grade sighted children. Twelve subjects in each grade with IQ's ranging from 90-112 were evaluated on twenty-four paired associate items. All subjects received the material in three different methods: (1) through the visual modality, (2) through the auditory modality, and (3) through a combination of the auditory and visual modalities. Both the visual, and the combined auditory-visual methods resulted in significantly higher scores on the paired associate items than the auditory modality. Further, the younger children relied more on the auditory modality while the older children (over ten years of age) relied more on the visual modality.

For most children the two major modalities (audition and vision) reach a stage of equalized function by the age of nine. However, educators, must realize that many children will appear to have greater facility using one input pathway over another (Wepman, 1967). This is particularly true in the case of the VH.

Although touch and smell are important in the environmental awareness and mobility of the VH, hearing plays the major role in the mobility and independence of the VH (Robinson, 1968).

Auditory Modality in the Visually Handicapped

Localization of objects through audition is important for the VH. It is not likely that the VH have enhanced auditory acuity, but become expert in using auditory cues not consciously noted by others (Wyburn, Pickford & Hurst, 1964). Contrary to research findings (Axelrod, 1959; Calhoun, 1971; Hare, Hammil, & Crandell, 1970; Hayes, 1941; Simpkins, 1971), it is often assumed that with a loss of vision, the remaining senses will automatically compensate through increased acuity. The difference is believed to be a matter of learning, rather than a change in physiological sensitivity (Robinson, 1968).

Calhoun (1971) suggested that the impaired sense should be used as much as possible, while the intact senses be used as the primary avenues of information gathering. Under normal circumstances, the most useful and most used informational and educational channel possessed by the VH person is hearing (Goldish, 1968). Cratty stated (1969) that audition is of such importance to the VH that auditory training should be employed as soon as possible.

Researchers have demonstrated that auditory presentation of most material is preferable to either Braille or large print (Goldish, 1968). Morris, Nolan and Phelps (1973) conducted a

study to determine the relative efficiency of auditory media on academic achievement. Fifty-six VH subjects in grades five through twelve used both recorded and textual materials in English, Math, Social Studies, Physical Science, and Language. No significant differences were found in the quality of learning. However, the recorded forms allowed 155% to 360% greater quantity of learning to occur in equal periods of time. Furthermore, 83% of the subjects expressed a preference for the recorded materials, excluding the areas of Math, Physical Science, and Language.

Hare, Hammil, and Crandell (1970) examined aspects of auditory discrimination in VH and sighted children. Thirty pairs of VH and sighted children were matched for chronological age and intelligence quotient. The auditory discrimination task consisted of discriminating whether pairs of sounds were the same or different. No significant differences were found between the VH and sighted children. This suggests that although hearing is the primary input modality for the VH, the prediction of superior auditory discrimination of the VH was not confirmed. Furthermore, when analyzing the data for significant differences in auditory discrimination ability based on degree of visual impairment (Group I subjects visual acuity equalled 5/200 or less, Group II subjects visual acuity equalled 6/200 to 20/200, and Group III, the partially sighted, visual acuity equalled 20/70 to 20/200), no significant relationship was found. It was concluded that the skill of auditory discrimination is not related to the degree of visual acuity.

In comparison with vision, the amount of information available through audition is meager. With no alternative in noncontact situations, the VH must rely on the auditory sense. A VH person deprived of sight becomes dependent on his hearing for maintaining adequate contact with his environment. Hearing becomes crucial in daily living for group conversation, family communication, social and recreational activities and mobility (Conkey & Schneiderman, 1968). As the VH individual moves, he will depend more on listening than on any other skill (Illinois State Office of the Superintendent of Public Institutions, 1972).

Nevertheless, problems do exist in relying on the auditory sense. One such problem is that few objects have characteristic sounds (Axelrod, 1959; Calhoun, 1971). Some of the problems when using auditory pathways for learning are: (1) ambient noise level, (2) effect of competing auditory stimuli, (3) localization ability, (4) long and short term auditory memory, (5) speed/noise ratio, (6) auditory discrimination, and (7) listening habits. Lydon and McGraw (1973) stated four criteria necessary for effective sound conceptualization: (1) awareness, (2) identification, (3) localization, and (4) discrimination. These four criteria must be trained in order to capitalize on the vital role which hearing plays in the life of the VH (Simpkins, 1971). Hearing is a skill which is not just dependent on proper functioning of the ear.

Auditory Training

One definition of auditory training is the use of techniques to improve an individual's ability to identify sounds not previously recognized, and to discriminate sounds as different from each other. One purpose of auditory training for the VH, is to improve orientation by obstacle detection and identification (Wright & Dupress, 1962). Research has demonstrated that auditory training can significantly improve listening skills in both sighted (Desousa, 1967; Walsh, 1972) and VH populations (Simpkins, 1971).

Desousa (1967) conducted a study in which 90 subjects in the seventh grade were randomly selected to take part in a training program. All subjects had normal hearing and IQ's. Subjects were divided into three groups: (1) thirty subjects to receive traditional instruction in literature, (2) thirty subjects to receive instruction in listening, and (3) thirty subjects to receive no instruction. Pretest and posttest scores indicated statistical gains only in the group which received listening instruction.

Walsh (1972), in a more extensive investigation, administered auditory training twenty minutes per day, for a duration of six weeks to 212 subjects. Subjects ranged in age from five years, five months to six years, four months. All were determined to have normal hearing. Pretest and posttest scores revealed significant gains in auditory discrimination.

Simpkins (1971) also conducted a study on the effect of an auditory training program with fifty-five VH students from

kindergarten through third grade. Subjects were residential students from the Overbrook School for the Blind with normal hearing. Fourteen students were randomly selected for the pre-test. After fifteen minutes, twice per day for a duration of six weeks, fourteen students were randomly selected for the post-test. The specific areas tested were (1) environmental sounds, (2) language and story, involving auditory memory, and (3) language without story. Significant improvement was shown only on the measure of environmental sounds, however, language without story approached significance. Language and story, the measure of auditory memory did not reveal any training effect. It can be concluded that specific factors of auditory perception can be improved through training.

Audition in Gross Motor Performance

The void in the literature pertaining to the role of audition in gross motor skill performance by the VH necessitated reliance on the available information pertaining to audition in gross motor skill performance by the sighted.

Docherty (1972) investigated the importance of auditory cues on gross motor tasks by highly skilled tennis players. Eighteen varsity tennis players were tested under three sound conditions: (1) control sound, (2) reduced sound, (earmuffs were utilized to reduce sound by eight decibles), and (3) masked sound. The task consisted of a wall rally for accuracy, and a singles, game-like

task. Subjects were free to use as many of the basic strokes (forehand drive, backhand drive, and volley) as necessary. Information was collected objectively through accuracy scores, and qualitatively through subject response questionnaires. It was concluded that the inherent sound cues associated with a wall rally task seemed to have relatively little effect on the performance of a task by highly skilled tennis players. On the basis of qualitative data, the inherent sound cues were found to provide some information in the game-like situation, but the effect of reducing or masking these cues was dependent on the individual player. However, this study was conducted on highly skilled, sighted players. Furthermore, the quality of the subject's auditory sense was unknown. It is for these reasons that the information provided in this study must be interpreted with some reservation in reference to the value of auditory cues for the VH.

Dillon (1952) studied the use of auditory aids in swimming. In accordance with the belief that rhythm is of great importance for swimming speed and form, music was introduced as an aid. Two hundred and forty college subjects were studied over a three year period. Subjects were randomly assigned to either a non-music or music group. Both groups of subjects were pretested, given twelve sessions of instruction then posttested. Speed was measured by a stop watch, and form was measured subjectively by three aquatic officials according to the Official Aquatics Guide. It was concluded that swimmers taught with music improved more in speed and form than the control group.

Similar results were found by Beisman (1964) who employed various auditory aids (tape recorded music, records, piano, singing, clapping, and percussion instruments) to ascertain the effect of rhythmic cues on fundamental motor skills of elementary school children. Six hundred and seven boys and girls in grades one through six participated in a physical education program two times per week for ten weeks. All subjects were pretested and posttested. Three hundred and three subjects received twenty minutes per class of rhythmically cued skills, and three hundred and four subjects received no rhythmic accompaniment. The fundamental motor skills consisted of a vertical jump for height, four leaps for distance, dodging, basketball dribbling, wall volleying, an accuracy throw, climbing an inclined ladder, and walking a balance beam. Those children in the experimental group of both sexes, in all grades improved significantly. It was concluded that rhythmic accompaniment is more effective for the teaching of selected motor skills to elementary school children than teaching without rhythmic accompaniment. The rhythmic accent and intensity of the media provided a sensory stimulus as an aid to performance.

Summary

A review of the literature has revealed that audition is important to both visually handicapped and sighted populations in several aspects. First, it is audition which permits localization

and identification of sounds. Secondly, it is audition which grants the visually handicapped a great deal of independence. Audition was indicated by many authorities as the primary modality through which the visually handicapped learn. In regard to gross motor skills, audition was found to have some degree of importance in tennis, swimming, and fundamental skills of physical education. Wright and Dupress (1962) suggest that auditory training is of paramount importance in order to maximize the visually handicapped individual's mobility and orientation to his environment.

In attempting to assist the learner in motor skill acquisition, there are a variety of valuable aids. However, when a visual impairment is present, the aids must either be of a multisensory nature, or must not rely upon vision. Auditory devices are used with little reservation by physical educators of the visually handicapped (Berne, 1975). However, research is not presently available to support or reject the practical application of many of these devices.

The recent emphasis on lifetime sports and leisure time activities has brought about significant changes in school physical education and recreation curricula. Bowling is one sport which has lifetime implications for it is enjoyed by men and women of all ages (American Association of Health, Physical Education and Recreation, 1970). Bowling is also a sport which is widely used in physical education curricula for the visually handicapped. It

serves as a social catalyst, and has great value in building self confidence, independence, and self awareness (Pitzer, 1974). Bowling has been acclaimed for its social and recreational value for the visually handicapped (Buell, 1966; Miller, 1971, 1975; Pitzer, 1974). Based on information regarding the increased efficiency of studying through the auditory modality, it is postulated that audition may also improve gross motor performance by the visually handicapped. With this information in mind, the present study was designed to investigate the effect of an audible goal locater on visually handicapped bowling performance.

CHAPTER III

METHODS AND PROCEDURES

Auditory aids are frequently used in physical education programs for the visually handicapped, however, bowling is one activity in physical education curricula where auditory aids have not been employed substantially. The inherent values of bowling for the visually handicapped merit the effort necessary to improve bowling performance. Due to the lack of specific research, this study has investigated the effect of the audible goal locater on bowling performance by the visually handicapped.

This chapter consists of six parts. The first section presents the procedures of subject selection and grouping. Section two consists of the rationale for the selection of this specific motor task. Section three covers the apparatus. In section four the experimental design is presented. Section five is a discussion of the testing procedures, administration of the task, and the testing environment is provided. The final section explains the statistical analysis of the data collected.

Subject Selection and Grouping

Subjects for this study were students at the New York State School for the Blind, a residential school for the blind located in Batavia, New York. A total of thirty subjects ranging in age from eleven to twenty-one years were utilized. This age range was selected

so that the task would not be novel to any of the subjects. All subjects participating in this investigation have previously been exposed to bowling through the physical education curriculum.

All subjects were legally blind. It was ascertained that no one participating in this investigation could see the pins. The thirty subjects were grouped according to the age of onset of visual impairment: fifteen congenitally blind, and fifteen acquired blind.

Calhoun (1971) found that forty out of four hundred and fifty-three VH students in residential schools (8.3%) suffered from auditory deficiencies. Medical records were reviewed in order to prevent any hearing impaired subjects from participating in this study, and to determine the age of onset of the visual impairment. School psychological records were also reviewed to insure the investigator that all subjects were of normal or above average intelligence.

Subjects were randomly assigned to one of four task sequences, consisting of bowling two days with the audible goal locater, and two days without the audible goal locater.

Motor Task

The motor task selected for this investigation was bowling. Each subject bowled fifteen balls per day for two days for a distance of sixty feet with the use of the audible goal locater, and fifteen

balls per day for two days a distance of sixty feet without the audible goal locater (refer to Figure 1). Each subject bowled five warm-ups per day preceding the actual fifteen trials. The rolling of the five warm-up balls were performed under the identical treatment conditions as the fifteen game balls which succeeded. The warm-ups served the purpose of acquainting the subjects with the equipment and procedures. The rationale for the selection of four days of fifteen balls as the task is based on the fatigue factor which might prohibit the child from rolling more than fifteen balls per day (plus five practice rolls per day).

The audible goal locater was placed a distance of fifteen feet from the foul line. This was based on the results of a pilot study conducted by the investigator of five subjects who bowled utilizing the locater at various distances (refer to Appendix D).

Apparatus

This study was designed in such a manner as to produce the fewest modifications possible in the usual bowling technique of the VH. It is for this reason that regulation pins were utilized, placed at the regulation distance of sixty feet. The ball used was six pounds in weight. This ball was utilized in order to maintain uniformity, and to be assured that the ball could be handled by all subjects. The aluminum guide rail, as pictured in Figure 2, is also standard bowling equipment of the VH. This guide rail is of

Figure 1

Illustration of Simulated Bowling Environment

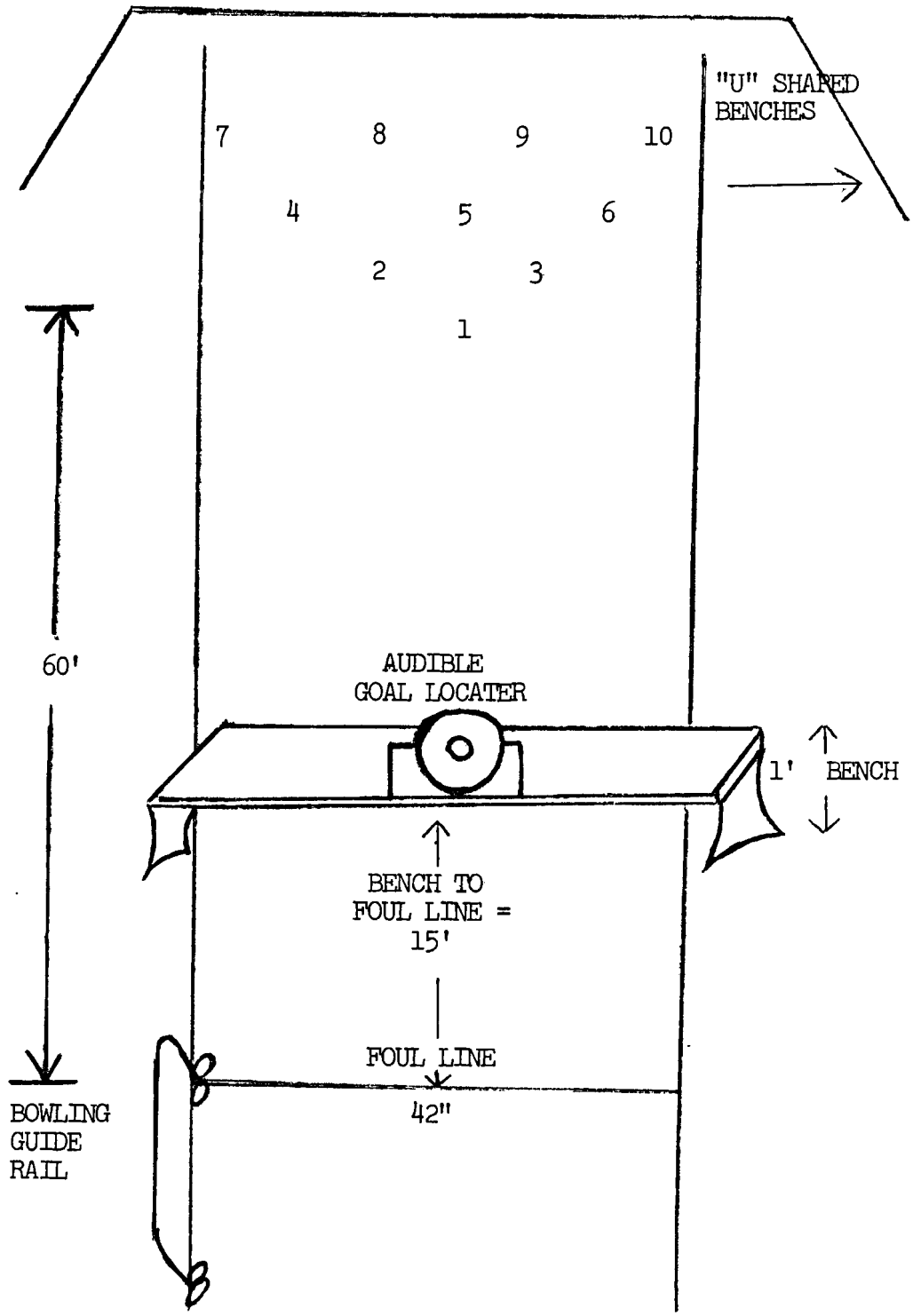
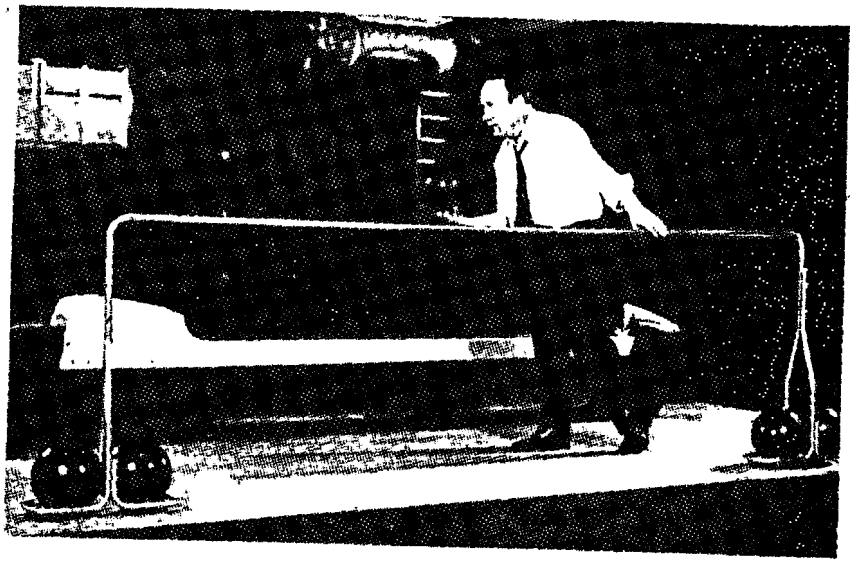


Figure 2

Aluminum Guide Rail



lightweight, detachable tubing which measures nine feet long by three feet high. This rail was placed directly behind the foul line, in line with the gutter, and served the purpose of providing kinesthetic guidance, and point of release cues.

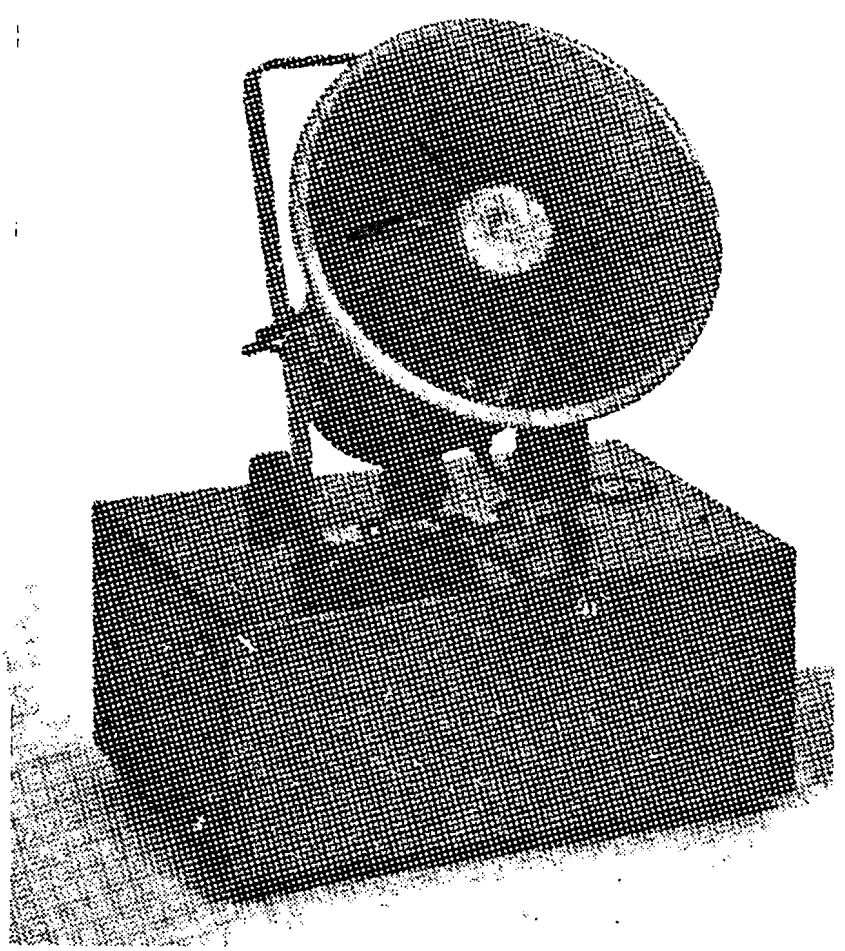
Markings of a bowling lane were taped on the floor to equal an actual lanes specifications. The lane measured forty-two inches in width, by sixty feet in length (42" x 60') from the foul line to the center of the head pin.

Two additional pieces of apparatus were introduced which were experimental in nature. The first, a bench which is one foot high by six feet long (1' x 6') was placed a distance of fifteen feet from the foul line. The height of the bench cleared the diameter of the ball (8.59") plus allowed for any possible loft the ball may have. The width of the bench must be wider than the forty-two inches of a bowling lane. The distance of the bench placement was based on the results of a pilot investigation to determine the most effective spot for the placement of the sound.

The purpose of the bench was to serve as a base on which to place the audible goal locater. The goal locater measures ten inches high by six inches deep by eight inches wide (refer to Figure 3). The frequency of the goal locater was set at 900 cycles per second, emissions at 210 pulsations per minute, and volume at one half the maximum throughout the testing of all thirty subjects. Wever (1949) reported that phases up to 1000 cycles per second permit

Figure 3

Portable Model Audible Goal Locater



easy judgement of sound direction. It is for this reason that the frequency of the audible goal locater was held constant at 900 cycles per second. The quality of the sound was well within a tolerable range of normal hearing individuals.

The locater was turned on from the moment the subjects picked up the ball, until the ball passed, or knocked down the pins. By so doing, the need for auditory memory was reduced. Rees (1965) found that the ability to localize a continuous sound source was superior to the ability to localize a fleeting signal.

Five additional benches, padded with mats, were used in a "U" formation around the pins in order to prevent wide dispersal, and to facilitate easy resetting upon being knocked down. Subjects were permitted to bowl in whatever sytle (approach and delivery) as they were normally accustomed to using.

Design

The design was constructed in order to study the effect of an audible goal locater on the VH in the performance of a specific motor activity. All subjects were tested with and without the audible goal locater. The subjects were randomly assigned the task sequence, the four possible sequences being:

Sequence I:	with, with, without, without
Sequence II:	without, without, with, with
Sequence III:	with, without, with, without
Sequence IV:	without, with, without, with.

Subjects served as their own controls, each being tested under the two different conditions. In this manner it could be determined

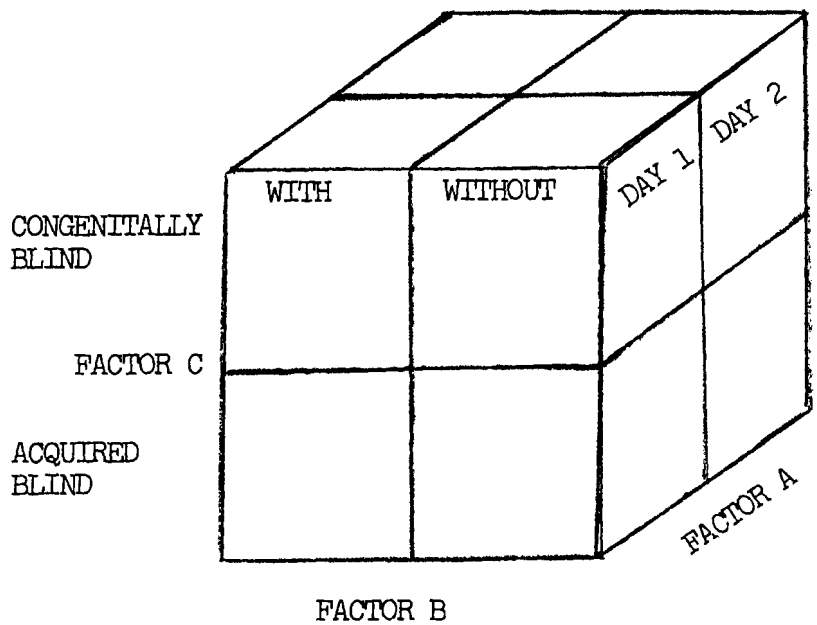
whether the changes in score were due to the actual method under investigation, or if the change was due to artifacts jeopardizing internal validity. The design is represented graphically in Figure 4. Factor A consists of two levels dealing with day of treatment. Factor B consists of two levels dealing with mode of treatment. Factor B_1 represents trial with the locater, and B_2 represents trial without the locater. Factor C consists of two levels which deal with age of onset of the visual impairment. C_1 represents those subjects with a visual impairment originating either prenatally or natally. Factor C_2 represents those subjects who have acquired their visual impairment sometime after birth. Scores were recorded on the basis of the number of pins knocked down. Each trial was equal to a maximum score of 150, totaling a maximum of 300 points for two trials with, and 300 points for two trials without the locater. Strikes were equal to the unit pin value of ten points, with pins being reset for each succeeding frame.

Testing Procedures, Administration, and Environment

Physical education was scheduled daily at the New York State School for the Blind. This enabled the investigator to visit the school daily for one week. Each subject was individually escorted to the testing environment. All subjects bowled thirty balls with and thirty balls without the audible goal locater. Five practice throws were allowed each day for warm-up purposes before starting.

Figure 4

Graphic Illustration of a 2 x 2 x 2 Design



Factor A_1 - Day one
Factor A_2 - Day two

Factor B_1 - Trial with the locater
Factor B_2 - Trial without the locater

Factor C_1 - Congenitally blind subjects
Factor C_2 - Acquired blind subjects

An aid accompanied the investigator to assist in recording, setting up the pins, and escorting the subjects to the testing environment.

The task was presented to the subjects as a contest in order to increase motivation. Personalized trophies were awarded to the six subjects who bowled the highest scores. All other subjects received loving cups for sportsmanship.

As the subjects entered the testing environment, they were turned in a circle and asked to point towards the head pin in order to ascertain whether the pins were within the child's vision. They were then told how the equipment was situated around the room, and instructions were read. The following introductory paragraph was read to all subjects:

> I have created in your skating rink a bowling lane. You will be participating in a contest to determine who the bowling champions in your school are. Each of you should try your best, because there will be prizes specially selected for the best bowlers. You will get a chance to try two different kinds of bowling. Prizes will be awarded for the champions of each kind, so if you are good enough, it's possible that you may win two prizes.

Subjects were then informed of the order of their task sequence, and received directions which were appropriate for the particular phase of the testing sequence:

Phases without the locater:

> You will be bowling fifteen balls as you ordinarily do. I have set up the guide rail for you, and here is the ball you are to use. I'll keep score and tell you when to bowl. Because this is a contest, it wouldn't be

fair for me to try to teach you to be a better bowler. I'm only going to tell you where your ball went, and how many pins you knocked down. Are there any questions?

Phases with the locater:

You will be bowling fifteen balls as you ordinarily do, except for one extra advantage. The guide rail is here for you like always. The extra advantage is that from about fifteen feet in front of you, you will hear a beeper. That sound is straight in line with the head pin so aim for the sound. I'll keep score and tell you when to bowl. But because this is a contest, it wouldn't be fair for me to try to teach you how to be a better bowler. I'm only going to tell you where your ball went in relation to the beeper, and how many pins you knocked down. Are there any questions?

All subjects were tested on an individual basis in the school skating rink by the investigator and an aid. The skating rink was selected for several reasons. First, practicality did not allow the use of public lanes on an individual basis. Transportation of subjects one at a time, and alley expenses made this impossible. Secondly, administrators consented to the use of class time, but would not allow the use of extracurricular bowling time. Thirdly, the skating rink offered far more control of external variables, such as noise which may compete with the audible goal locater. Lastly, the skating rink was constructed of a wood floor, which further simulated a bowling alley.

Statistical Analysis

Mean scores were compared to ascertain if visually handicapped bowling performance was significantly better with or without an audible goal locater. Also, subjects with acquired visual impairments

were compared to subjects with congenital visual impairments to determine if congenitally blind subjects differ significantly from acquired blind subjects on bowling. Further analysis was performed to determine if day one differed significantly from day two of each treatment method. The design used in this study was a three factor ANOVA (2 x 2 x 2; acquired or congenital blindness, with or without the locater, and day one versus day two) with repetition on two factors (with or without the locater, and day one and two). The IBM 1130 computer program RPEAT (design No. 3) at the State University College at Brockport, New York was utilized for statistical analysis.

CHAPTER IV

ANALYSIS OF DATA AND RESULTS

The data collected in this study were analyzed (1) to determine if bowling performance was significantly improved with or without the use of the audible goal locater, and (2) to determine if subjects who have acquired their visual impairments differ significantly from subjects who are congenitally blind on a bowling task. The results are presented in two sections. The first section contains the descriptive characteristics of the visually handicapped sample relevant to this investigation. The second section describes the experimental results.

Descriptive Comparison

A summary of the characteristics of the acquired and congenital visually handicapped subjects is presented in Table 1. Mean scores revealed that as a group, the congenitally visually handicapped subjects were 8.8 months older than the acquired visually handicapped subjects. Standard error of the mean differences were determined, and it was found that the difference was not significant. Further analysis revealed that the mean duration of attendance at the New York State School for the Blind was 36.87 months longer for the congenitally visually handicapped students. Standard error of the mean differences were determined, and it was found that the difference

was significant. In view of these significant findings, a correlation between duration of school attendance and bowling performance score with the locater was conducted, and it was determined that the relationship was slight to fair ($r = -.35$).

TABLE 1

Ranges, Means, and Standard Deviations of Specific Characteristics of the Acquired and Congenitally Visually Handicapped Sample

	Range	Mean	SD
Acquired			
Chronological Age (in months)	148-234	189.60	29.24
Length of time of attendance	17-120	55.33	31.81
Congenital			
Chronological Age (in months)	133-256	198.40	38.06
Length of time of attendance	27-150	92.20	38.16

The acquired group was composed of six males and nine females, while the congenital group was composed of seven males and eight females. The ethnicity of the sample was such that the acquired group was composed of eleven Caucasians and four Negroes, while the congenital group was composed of fourteen Caucasians and one Negro.

Because of small sample size, the variables of sex and ethnicity were not controlled in the present investigation. Based on standard psychometric intelligence tests all subject's intelligence quotients were either average or above average.

The significance of the following results were determined using the .01 level of significance.

Experimental Findings

The four day sequence of scores (two days with the audible goal locater, and two days without the audible goal locater) were recorded for each subject (Appendix C, Raw Scores). ANOVA indicated that the days factor was not significant. Therefore, subject's two day scores for each treatment were averaged to produce a mean score with and without the locater. The mean scores are summarized in Table 2.

A three dimensional repeated measures design with repetition on two factors was used to analyze the three main variables of treatment (with or without the audible goal locater), onset of visual impairment (acquired versus congenital), and days (day one versus day two of each treatment).. Table 3 indicates that the use of the audible goal locater significantly improved bowling performance by congenitally and acquired blind subjects regardless of the visual impairment, thus substantiating the hypothesis ($F = 22.56$, $1,28$; $p < .01$). The findings of the present study extend the results of Beisman (1964), Dillon (1952), and Morris, Nolan, and Phelps (1973) in which the effectiveness of the subject's performances were increased through the

Table 2

Ranges, Means, and Standard Deviations of the
Acquired and Congenital Visually Handicapped Subjects
Bowling Performance Scores With and Without the Audible Goal Locater*

	Range	Mean	SD
Acquired			
With	6.50-83.00	42.20	22.22
Without	8.00-74.00	28.93	17.19
Congenital			
With	1.50-61.50	21.70	18.56
Without	0.00-35.00	11.30	11.58

*Data are based on each subject's two day average

Table 3

Three Dimensional Repeated Measures ANOVA (2 x 2 x 2)
of Onset of Visual Impairment, Treatment, and Days

Source of Variation	MS	F	df	p
Among Subjects				
C (Acquired vs. Congenital)	11271.42	10.97	1	$< .01$
Subjects	1027.40		28	
Within Subjects				
A (Days)	350.21	1.93	1	
AC	676.85	3.74	1	$> .05$
AS	180.93		28	
B (With vs. Without Locater)	4477.42	22.56	1	$< .01$
BC	98.96	0.49	1	$> .05$
BS	198.38		28	
AB	57.39	0.33	1	$> .05$
ABC	18.42	0.10	1	$> .05$
ABS	171.47		28	

utilization of auditory cues. Further, it was found that acquired visually handicapped subjects bowling scores were significantly superior to the congenitally visually handicapped subjects, regardless of the treatment ($F = 10.97$, 1,28; $p < .01$). No significant differences were found for day one versus day two of each treatment method. Also interaction terms were not significant.

Summary

The hypothesis of this investigation was accepted. The use of the audible goal locater can significantly improve bowling performance by the visually handicapped. Further analysis revealed that the acquired visually handicapped were significantly superior to the congenitally visually handicapped on bowling tasks with and without the utilization of auditory cues.

CHAPTER V

SUMMARY AND DISCUSSION

The purpose of this study was to investigate the effect of auditory cues on the bowling performance of visually handicapped students. A total of thirty legally blind residential students (N = 15 acquired and N = 15 congenital) from the New York State School for Blind in Batavia, New York between the ages of eleven and twenty-one were utilized for the present investigation. School psychological and medical records were reviewed in order to determine if all subjects were of normal or above intelligence, without hearing impairment, and onset of impairment of the child (acquired or congenital). Before testing, it was ascertained that each had some previous bowling experience, and that the pins could not be seen. This was accomplished by asking each child to point to the pins. The possibility that any subjects with residual vision may have received visual cues from the locater was controlled only through maintaining the locater in a fixed position throughout all testing phases of all subjects.

The testing consisted of bowling on four days. Subjects were randomly assigned to bowl two of the four days utilizing only the aluminum guide rail and a six pound ball, and two of the four days utilizing the aluminum guide rail, the ball, and the audible goal locater. The aluminum guide rail and the six pound ball were used

by all subjects in order to maintain uniformity. Subjects bowled five warm-up balls, and fifteen game balls per day.

The tasks were conducted in the school skating rink. The skating rink enabled the investigator to simulate a bowling lane through the utilization of regulation pins, regulation size (60' x 42"), and a wood surface floor. A six foot long by one foot high bench was placed fifteen feet from the foul line to support the audible goal locater. The placement of the locater was determined by the results of a pilot investigation (refer to Appendix D). Five additional benches of similar size were padded with mats and arranged in a "U" formation behind the pins to prevent wide pin dispersal and facilitate easy resetting.

The audible goal locater remained in place through all phases of testing, and was operated by the investigator. During those phases requiring the utilization of the audible goal locater, it was turned on from the moment the subjects received the ball, until the ball either knocked down the pins or went out of bounds (gutter ball).

Test administration was conducted primarily during study halls, physical education class, orientation and mobility, lunch recess, after school, and on weekends in order to reduce any disturbance to classroom activities. Upon completion of testing, first, second, and third place trophies were awarded, and loving cups were

distributed to all other participants who did not place. The investigator was accompanied by a Master's student in Special Physical Education who served as an aid.

The results of this investigation support the hypothesis that the utilization of auditory cues can significantly improve visually handicapped bowling performance. This concurs with the findings of Beisman (1964), Dillon (1952), and Morris, Nolan and Phelps (1973) in which auditory aids increased performance in both scholastic and gross motor tasks. There is an abundance of literature regarding the probable importance of audition to the visually handicapped (Calhoun, 1971; Cratty, 1969; Goldish, 1968; Simpkins, 1971) in both academic and daily living. There is concensus among the literature concerning the need for the visually handicapped to capitalize on audition, and the implications this holds for auditory training. In contrast, there is a scarcity of research pertaining to the role of audition in gross motor skill performance. The results of the present investigation indicate that the findings of related research in which performance was enhanced through audition also applies to the visually handicapped in a specific gross motor task. It should be remembered that this investigation dealt specifically with bowling performance. For this reason these findings should not be generalized to other sport and leisure time activities.

Second, differences appeared between the acquired and congenitally visually handicapped subjects which substantiates the

findings of many investigators. The quality of complex performance is directly related to the degree of visual impairment, and the duration of life in which vision was retained (Buell, 1950). Rubin (1964) stated that the later visually handicapped (after two years of age) are superior in form recognition and spatial orientation when intelligence is controlled. Axelrod (1959) reported that the level of performance in complex tasks is directly related to the age at which vision is lost. Those who retained vision longer were superior in spatial problem solving, form generalization and discrimination all of which are inherent in bowling by the visually handicapped. These results may be further explained through subjective observation by the investigator. All students at the New York State School for the Blind are classified as legally blind. This, however, encompasses a wide range of visual acuity (20/200 in the better eye with correction, or worse). It seemed that several of the subjects in the acquired group were at the higher end of the spectrum of legally blind visual acuity. This may be due to the progressively degenerative nature of some acquired visual impairments, ie: primary glaucoma, corneal opacity, acquired syphilis, optic nerve atrophy, albinism, infectious diseases, or diabetic retinopathy (Zahl, 1962). The findings of the present investigation support the literature.

Also, the lack of significant differences from day one to day two of each treatment method was an expected result due to the

randomization of the task sequence. The randomization process controlled for the possibility of learning which may have been incurred during the previous day's experiences. This study was completed over a short period of time (four successive days for each subject) in order to further minimize the effects of learning. Presentation of the tasks as a contest may also have controlled for the appearance of any significant differences from day one to day two by maintaining constant motivational levels.

Upon completion of the testing, subjects were debriefed and asked to freely comment about their feelings of each treatment method. Subjects were aware of their personal daily scores, and appraised the locater as being generally helpful. The primary criticism concerning the locater was it was an unpleasant sound. Subjects would have preferred either a lower frequency, or a flowing sound (such as music, rather than pulsations). Another criticism was that by not having an actual gutter which drops off from the surface of the lane, the subjects were deprived of guidance concerning the width of the lane, direction for squaring up before releasing the ball, and sound cues as to when the ball goes out. Some of the older subjects also criticized the ball as being too light or that the finger holes were too small.

Conclusion

In conclusion, the use of the audible goal locater significantly improved visually handicapped bowling performance. It was further

concluded that the acquired visually handicapped subjects were significantly superior bowlers when compared to bowlers with congenital visual impairments.

Recommendations for Further Research

Based on the findings of this study, the following directions for future research are suggested:

1. This study pertained only to a bowling task. Similar studies should be conducted to determine the efficiency of auditory aids for the visually handicapped in other sports and leisure time activities.

2. After completion of testing, subjects were debriefed and asked to comment. The following suggestions are based on subjects' responses:

a. This study was conducted in a skating rink which did not have a gutter which drops off from the surface of the lane. Several subjects revealed that a gutter provides cues concerning the width of the lane, direction for squaring up, and sound cues which indicate when the ball goes out of bounds. With these considerations in mind, a similar study should be conducted in an actual bowling alley.

b. Based on subjects' responses regarding the quality of sound, a similar study should be conducted to determine the most efficient and pleasant type of auditory cues.

c. Based on subjects responses regarding the weight and finger hole size of the ball, a similar study should be conducted

in which subjects may choose the ball best suited to their individual preferences.

3. This study was concerned with performance rather than learning. A similar study should be conducted in which an auditory cue may be used as a temporary instructional aid and then removed in order to determine the value of auditory cues to enhance learning.

4. The pilot study that was performed in order to determine the most efficient placement of the sound source was based on a small sample of five. A similar study with a larger sample should be conducted to determine the most efficient placement of the sound source.

5. No subject who participated in the pilot investigation was able to see the locater at a distance of fifteen feet. There may be a possibility that subjects who participated in this investigation received visual cues from the goal locater. A future study should be conducted in which any possible visual cues of the locater are restricted.

6. It is presently unknown whether differences exist between public school visually handicapped and residential school visually handicapped students in the area of gross motor ability. A similar study of a comparative nature should be conducted between public school and residential school visually handicapped students.

REFERENCES

Adams, R.C., Daniel, A.N., & Rullman, L. Games, sports and exercises for the physically handicapped. Philadelphia: Lea & Febiger, 1972.

American Association for Health, Physical Education, and Recreation. New ideas for bowling instruction. Washington, D.C.: AAHPER Press, 1970.

Anderson, T. A study of visual aids in basket shooting. Research Quarterly, 1942, 13, 532-537.

Arnheim, D., Auxter, D., & Crowe, W. Principles of adapted physical education. St. Louis: C.V. Mosby Company, 1969.

Axelrod, S. Effects of early blindness-performance of blind and sighted children on tactile and auditory tasks. New York: American Foundation for the Blind, 1959.

Balmer, L. A guidance device for a blind athlete. Medical and Biological Engineering. 1970, 8, 301-307.

Beisman, G.L. The effect of rhythmic accompaniment during teaching of fundamental motor skills to elementary school children. Unpublished doctoral dissertation, State University of New York at Buffalo School of Education, 1964.

Berne, S. Personal communication. Colorado Springs, Colorado: Colorado School for the Deaf and Blind, January 1975.

Bruininks, R.H. and Clark, C. Auditory and visual learning in first, third, and fifth grade children. Minnesota Research, Demonstration Center in the Education of the Handicapped, November, 1970.

Buell, C.E. Motor performance of visually handicapped children. Journal of Exceptional Children, 1950, 17, 69-73.

Buell, C.E. Physical education for blind children. Springfield, Illinois: Charles C Thomas, Publisher, 1966.

Buell, C.E. Physical education and recreation for the visually handicapped. Washington, D.C.: AAHPER Press, 1973.

Calhoun, J.R. Learning pathways. Education of the Visually Handicapped, December, 1971, 13, 106-109.

Conkey, E.L., & Schneiderman, C.R. The effect of contralateral routing of sound on auditory localization and mobility of a blind person. Exceptional Children, 1968, 34, 705-709.

Cratty, B.J. Movement behavior and motor learning. Philadelphia: Lea & Febiger, 1967.

Cratty, B.J. Perceptual motor behavior and educational processes. Springfield, Illinois: Charles C Thomas, Publisher, 1969.

Dale, E. Audio-visual methods in teaching. New York: Henry Holt and Company, Inc., 1959.

DeSousa, A.M. The effect of training on the listening ability of seventh grade students. Unpublished doctoral dissertation Rutgers University, 1967.

Dillon, E.K. A study of music as an aid in teaching swimming. Research Quarterly, 1952, 23, 1-8.

Docherty, E.M.H. The effects of reducing and masking the auditory cues accompanying performance of select gross motor tasks on the performance of those tasks. Unpublished doctoral dissertation, Ohio State University, 1972.

Gibson, J.J. The senses considered as perceptual systems. Boston: Houghton Mifflin Company, 1966.

Goldish, L.H. Teaching aids for the visually handicapped. Brighton Massachusetts: Perkins Publications, 1968.

Hare, B.A., Hammill, D.D., & Crandell, J.M. Auditory discrimination ability of visually limited children. New Outlooks for the Blind, 1970, 64, 287-293.

Hayes, S.P. Contributions to the psychology of blindness. New York: American Foundation for the Blind, 1941.

Hewett, F.M. Education of exceptional learners. Boston: Allyn and Bacon, Inc., 1974.

Illinois State Office of the Superintendent of Public Institutions. Preschool learning activities for the visually impaired. Springfield, Illinois: Springfield Instructional Materials Center, 1972.

Kaye, R.A. The use of waist type flotation device as an adjunct in teaching beginning swimming skills. Research Quarterly, 1965, 36, 277-81.

Lauer, H. Sensory aids for the blind; are they automatic bonus or needed tools?. Education of the Visually Handicapped, 1971, 3, 111-115.

Lindeburg, F.A., & Hewitt, J.E. Effect of an oversized basketball on shooting ability and ball handling. Research Quarterly. 1965, 36, 164-167.

Lydon, W.T., & McGraw, M.L. Concept development for visually handicapped children: A resource guide for teachers and other professionals working in educational settings. New York: American Foundation for the Blind, 1973.

Mathews, D.K. & McDaniel, J. Effectiveness of using golf-lite in learning the golf swing. Research Quarterly, 1962, 33, 448-491.

Miller, O.O. Blind bowling. Journal of Health, Physical Education and Recreation, 1971, 42, 59-61.

Miller, O.O. Personal communication. Washington, D.C.: President of the American Blind Bowling Association, April 16, 1975.

Morris, J.E., Nolan, C.Y., & Phelps, B.G. Aural study systems for the visually handicapped. Louisville, Kentucky: American Printing House for the Blind, April 30, 1973.

Pitzer, J. Leisure time activities for the visually impaired. Journal of Health, Physical Education and Recreation. 1974, 45, 69-70.

Rees, M.J. Auditory rehabilitation for hearing impaired blind persons, American Speech and Hearing Monographs, 1965, 12, 1-96.

Robinson, J.P. Auditory efficiency among blind and sighted listeners as measured by signal detection measures. Unpubliched doctoral dissertation, Vanderbilt University, 1968.

Rubin E.J. Abstract functioning in the blind. New York: American Foundation for the Blind, 1964.

Schrader, C.W. The effect of differences of five different aspects of vision on hand-eye coordination performance. Unpublished doctoral dissertation, Auburn University, 1968.

Simpkins, K. An auditory training program for kindergarten through third grade. Education of the Visually Handicapped, 1971, 3, 71-74.

Taylor, W. Physical education for the blind and partially sighted. Unpublished master's thesis, Ohio State University, 1951.

University of the State of New York, State Education Department. Physical education for the exceptional child. Albany: 1970.

Walsh, J. The effect of known auditory perceptual training program on selected auditory abilities. Unpublished doctoral dissertation, New York University, 1972.

Watkins, D.L. Motion pictures as an aid in correcting baseball batting faults, Research Quarterly, 1963, 34, 228-233.

Wepman, J.M. The modality concept-including a statement of the perceptual and conceptual levels of learning. Paper presented at The International Reading Association, Seattle. Washington: 1967.

Wever, E.G. Theory of hearing. New York; John Wiley and Sons Inc., 1949.

Wright, H.N., & Dupress, J.K. Identifying and teaching auditory cues for traveling by the blind, American Foundation for the Blind Research Bulletin, 1962, 1, 3-9.

Wyburn, G.M., Pickford, R.W., & Hurst, R.J. Human senses and perception. Toronto: University of Toronto Press, 1964.

Zahl, P.A. Blindness: modern approaches to the unseen environment. New York: Hafner Publishing Company, 1963.

APPENDICES

APPENDIX A

LETTER REQUESTING PARENTAL PERMISSION

May 16, 1975

Dear Parent or Guardian,

Leisure time activities have considerable physical, social and emotional benefits for the visually handicapped. The need to improve the recreational skills of these individuals is apparent. One means of assisting the visually handicapped individual in physical education and recreation may be the utilization of auditory aids. However, it is presently not known what effect auditory aids have on increasing the visually handicapped individual's skill.

In the near future a study will be conducted at the New York State School for the Blind to determine the efficiency of using auditory aids to improve recreational skills such as bowling.

This letter is to request your permission for _____ to participate in a simulated bowling task. This task will be conducted in the school skating rink. Testing will occur for approximately fifteen minutes on four separate days. The identity of your child will remain anonymous.

If you have any questions regarding the involvement of your child and/or this study, please contact:

Miss Carol Reid
c/o Sam Paradise
Department of Physical Education
New York State School for the Blind
Batavia, New York 14020
[redacted]

Please complete the following form and return to the above office as soon as possible.

I give my consent for_____to participate in this study. At your request a summary of this study will be mailed to you. ____ ____
yes no

Signed_____

APPENDIX B

SAMPLE SCORE SHEET

SCORE SHEET

Name_____ I.D.___ Acquired___ Congenital___ AGE___ Time at NYSSB_____ COMMENTS_____

Teacher and room from_____

Time of day_____. Sequence: I II III IV TOTALS: WITH___ WITHOUT_____

TRIAL	I WITHOUT	II WITHOUT	III WITH	IV WITH
a				
b				
c				
d				
e				
Practice Totals				
1.				
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
13				
14				
15				
16				
17				
18				
19				
20				
TOTALS				
FOULS				

APPENDIX C

RAW SCORES OF ACQUIRED AND CONGENITAL VISUALLY HANDICAPPED BOWLING PERFORMANCE WITH AND WITHOUT THE AUDIBLE GOAL LOCATER

RAW SCORES OF ACQUIRED AND CONGENITAL VISUALLY HANDICAPPED BOWLING PERFORMANCE WITH AND WITHOUT THE AUDIBLE GOAL LOCATER

ID	Acquired With Day 1,2	Acquired Without Day 1,2	ID	Congenital With Day 1,2	Congenital without Day 1,2
1	79, 47	26, 51	16	23, 21	00, 00
2	53, 66	49, 42	17	37, 47	09, 36
3	33, 46	20, 17	18	63, 20	50, 08
4	66, 69	11, 12	19	05, 24	06, 00
5	13, 00	26, 10	20	00, 11	06, 06
6	17, 36	03, 39	21	05, 17	00, 05
7	14, 33	20, 13	22	04, 06	32, 08
8	16, 19	03, 21	23	00, 31	10, 04
9	09, 56	41, 26	24	71, 52	37, 33
10	14, 69	09, 07	25	01, 02	03, 00
11	72, 94	66, 80	26	24, 07	00, 06
12	24, 29	17, 51	27	42, 46	03, 34
13	61, 66	28, 44	28	35, 36	28, 10
14	35, 47	25, 26	29	05, 00	00, 00
15	60, 44	44, 39	30	16, 00	00, 05
Sub-Totals	566,721	388, 478		331,320	184,155
Daily Means	37.73, 48.06	25.86, 31.20		22.07, 21.33	12.27, 10.33
Totals	1287	866		651	339
Two day Treatment Mean	42.90	28.87		21.70	11.30

APPENDIX D

RESULTS OF PILOT INVESTIGATION TO DETERMINE PLACEMENT FOR AUDIBLE GOAL LOCATER

RESULTS OF PILOT INVESTIGATION TO DETERMINE
PLACEMENT FOR AUDIBLE GOAL LOCATER *

Placement of Goal Locater

Subject	15' from foul line	TOTAL	30' from foul line	TOTAL	45' from foul line	TOTAL	at the pins	TOTAL
J.Q.	5 0 0 7 0	12	0 0 0 0 0	0	5 0 5 0 0	10	5 0 0 0 0	5
P.H.	0 0 1 0 0	1	0 1 0 0 0	1	7 7 0 0 0	14	5 0 3 1 6	15
C.L.	0 0 6 10 7	23	0 0 0 2 0	2	3 0 1 5 2	11	0 0 0 0 0	0
J.R.	6 10 6 8 0	30	0 8 1 6 10	25	0 0 10 1 0	11	1 1 3 7 0	12
K.H.	0 6 7 0 0	13	1 8 1 3 1	14	0 10 8 4 0	22	0 0 0 0 0	0
TOTAL		79		42		68		39

*Data were based on sample of 5 visually handicapped students

APPENDIX E

FOLLOW UP THANK YOU LETTER

June 26, 1975

[redacted]

To the Faculty and Staff of:
The New York State School for the Blind
Batavia, New York 14020

I would like to take this opportunity to express my extreme gratification to you for all the invaluable assistance you rendered, and to apologize for any possible inconveniences I may have caused during the research project I carried out at your school.

The results of my study indicated that the utilization of the audible goal locater was a highly significant aid for bowling by the visually handicapped. I hope these results may somehow be a benefit to your students in the future.

A copy of the completed thesis will be presented to your school library within the next few months. Abstracts of the investigation will be forthcoming shortly.

Again, thank you very much.

Sincerely,

Carol Reid